UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 26, 2012

Mr. Steven E. Sisley
Energy*Solutions*
Spent Fuel Division
2105 S. Bascom Ave., Suite 230
Campbell, CA 95008

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9276, REVISION NO. 4, FOR THE MODEL FUELSOLUTIONS™ TS125 TRANSPORTATION PACKAGE

Dear Mr. Sisley:

As requested by your application dated September 10, 2012, enclosed is Certificate of Compliance No. 9276, Revision No. 4, for the Model No. FuelSolutions™ TS125 Transportation Package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471.

If you have any questions regarding this certificate, please contact me or Huda Akhavannik of my staff at (301) 492-3273.

Sincerely,

Bernard H. White IV
for

Michael D. Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9276
TAC No. L24684

Enclosures: 1. Certificate of Compliance No. 9276, Rev. No. 4
2. Safety Evaluation Report

cc w/encls: R. Boyle, Department of Transportation
J. Shuler, Department of Energy
Registered Users

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9276	4	71-9276	USA/9276/B(U)F-85	1	OF	27

2. PREAMBLE

   a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

   b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. ISSUED TO *(Name and Address)*
EnergySolutions Spent Fuel Division
2105 S. Bascom Ave., Suite 230
Campbell, CA 95008

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
BNFL Fuel Solutions application dated April 20, 2001, as supplemented.

4. CONDITIONS
This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.
(a) Packaging

(1) Model No. FuelSolutions™ TS125 Transportation Package

(2) Description

The FuelSolutions™ TS125 Transportation Package consists of a TS125 Transportation Cask and impact limiters, together with a FuelSolutions™ W21 or W74 canister and its payload. The FuelSolutions™ canister and its payload are contained inside the TS125 Transportation Cask cavity. The TS125 Transportation Cask cavity is sized to accommodate one FuelSolutions™ long canister, or alternatively, one FuelSolutions™ short canister with a cask cavity spacer. The approximate dimensions and weights of the package are as follows:

Package Length: .... 342.4 inches
Package Outside Diameter: .... 143.5 inches
Cask Length (w/o impact limiters): .... 210.4 inches
Cask Outside Diameter (w/o impact limiters): .... 94.2 inches
Cask Cavity Length: .... 193.0 inches
Cask Cavity Diameter (section at rails): .... 66.88 inches
Canister Outside Diameter: .... 66.0 inches
Maximum Long Canister Length: .... 192.25 inches
Maximum Short Canister Length: .... 182.25 inches
Cask Cavity Spacer Length: .... 10.0 inches

Max. Package Weight: .... 285,000.0 pounds
Max. Cask Payload Weight (incl. canister and cavity spacer):......... 85,000.0 pounds

The TS125 Transportation Cask body is an assembly composed of stainless steel components of an inner shell, an outer shell, a top ring forging, a closure lid with a seal test port and a cavity vent port, a bottom plate forging, and a cavity drain port. The inner and outer shells are welded to the bottom plate forging and the top ring forging. The cask body also includes an annular lead gamma shield; an annular neutron shield with cask tie-down rings, support angles, and jacket; a bottom end neutron shield with a support ring and jacket; a longitudinal shear block; and lifting trunnion mounting bosses. The inner and outer shells form the annular cavity for the lead gamma shield. The outer shell and the neutron shield jacket form the annular cavity for the solid neutron shield. The neutron shield support angles facilitate heat rejection through the solid neutron shielding material to the outer surface of the cask body. The cask closure lid includes a thick recessed plate with two concentric "Helicoflex" silver-jacketed metallic o-ring seals, the cavity vent port, and the seal test port. The closure lid is secured to the cask body during transport with 60 – 2 inch diameter closure bolts. The vent and drain ports are closed by a plug assembly to maintain containment integrity during transportation.

The Transportation Cask's containment boundary consists of: the inner cylindrical shell, the bottom plate forging (which forms the bottom closure of the cask), the top ring forging and sealing surfaces, the closure lid and sealing surfaces, the welds associated with the above components, the closure bolts, the innermost closure lid o-ring seal, the cavity vent port seal gland and o-ring seal, and the cavity drain port seal gland and o-ring seal. The package is designed to be "leaktight" as defined by ANSI N14.5 (leakage rate less than or equal to 1×10^{-7} ref-cm^3/s. The structural components of the Transportation Cask are made of high-strength austenitic stainless steel. The gamma shielding is made of lead and is completely enclosed within the annular region between the inner and outer steel shells. The neutron shielding is solid hydrogenous material that is completely enclosed within the annular region between the cask outer shell and neutron shield jacket with tie-down rings at each end.

The FuelSolutions™ TS125 Transportation Cask has identical energy-absorbing impact limiters at both ends. Each impact limiter assembly consists of crushable aluminum honeycomb energy-absorbing core segments that are encased in a sealed stainless steel shell. In addition to confining the aluminum honeycomb core segments in the event of a free drop, the impact limiter shell protects the aluminum honeycomb material from the weather. Both the top and bottom impact limiters are attached to the transportation cask body tie-down rings with 12, one inch diameter bolts. A tamper-indicating device is provided which connects each impact limiter to the transportation cask to assure that the package has not been opened by unauthorized personnel during transport.

A FuelSolutions™ canister consists of a steel shell assembly and an internal basket assembly. The shell assembly maintains a helium atmosphere for transport conditions. Credit is not taken for containment provided by the canister shell for transport conditions. The shell assembly also provides radiological shielding in both the radial and axial directions. The internal basket assembly provides geometric spacing, structural support, and criticality control for the spent nuclear fuel (SNF) assemblies for transport conditions. here are two classes of W21 canisters (W21T and W21M), differing primarily in materials of construction. Each W21 canister class includes four different canister types, as follows. The W21T canister class includes a long canister with lead shield plugs

(W21T-LL), a long canister with carbon steel shield plugs (W21T-LS), a short canister with lead shield plugs (W21T-SL), and a short canister with carbon steel shield plugs (W21T-SS). The W21M canister class includes a long canister with depleted uranium shield plugs (W21M-LD), a long canister with carbon steel shield plugs (W21M-LS), a short canister with depleted uranium shield plugs (W21M-SD), and a short canister with carbon steel shield plugs (W21M-SS). There are also two classes of W74 canisters (W74T and W74M), differing primarily in materials of construction. Both the W74T and W74M canister classes include only a long canister with carbon steel shield plugs.

A FuelSolutions™ canister shell assembly consists of a steel cylindrical shell, bottom end closure, bottom shield plug, bottom shell extension, bottom outer plate, top shield plug, top inner closure plate, and top outer closure plate. The closure plates at the top and bottom are welded to the cylindrical shell. All structural components of the canister shell assembly are constructed of austenitic stainless steel, with the exception of the shield plugs. The shield plug materials may be composed of lead, depleted uranium or carbon steel, depending upon the specific canister variant. To prevent any corrosion, galvanic, or chemical reactions between the shield plug materials and the cask environment or contents, the shield materials are isolated from the environment and cask interior. The lower shield plugs are encased within stainless steel. The upper shield plugs that are made of lead or depleted uranium are encased in stainless steel. The carbon steel upper shield plug is electroless nickel-plated.

A FuelSolutions™ W21 canister basket assembly consists of 21 guide tubes that are positioned and supported by a series of circular spacer plates, which are in turn positioned and supported by support rod assemblies. The W21 guide tubes include neutron absorber sheets on all four sides.

The W74 canister includes two stackable basket assemblies with a capacity to accommodate up to 64 Big Rock Point fuel assemblies. Each basket includes 37 cell locations, with the center five cell locations mechanically blocked to prevent fuel loading in these locations. The W74 basket assembly consists of a series of circular spacer plates that are positioned and supported by four support tubes that run through the spacer plates and support sleeves between the spacer plates. Each basket cell location, with the exception of the four support tubes and the five blocked-out center cells, contain a guide tube assembly. The W74 guide tube assemblies include borated stainless steel neutron absorber sheets on either one side or two opposite sides. The guide tubes are arranged in the basket to position at least one poison sheet between adjacent fuel assemblies, with the exception of intact fuel assemblies placed in the support tubes.

In the W74 basket, damaged fuel is placed in damaged fuel cans that are accommodated in the support tube cell locations. The W74 damaged fuel cans are similar to the W74 guide tubes, but include a screened bottom end, a screened removal lid, and borated stainless steel neutron absorber sheets on all four sides.

(3) Drawings

The FuelSolutions™ TS125 Transportation Package is constructed and assembled in accordance with the following drawings:

FS-200, Revision 1, Sheets 1 through 3
FS-205, Revision 2, Sheets 1 through 3
FS-210, Revision 2, Sheets 1 through 9
FS-220, Revision 1, Sheets 1 through 7
FS-230, Revision 1, Sheets 1 and 2
W21-110, Revision 4, Sheets 1 through 9
W21-120, Revision 5, Sheets 1 through 10
W21-121, Revision 5, Sheet 1
W21-122, Revision 3, Sheets 1 and 2
W21-130, Revision 4, Sheets 1 through 9
W21-131, Revision 3, Sheets 1 and 2
W21-140, Revision 5, Sheets 1 through 4
W21-150, Revision 4, Sheets 1 and 2
W21-190, Revision 4, Sheet 1
W74-110, Revision 5, Sheets 1 and 2
W74-120, Revision 5, Sheets 1 through 6
W74-121, Revision 7, Sheet 1
W74-122, Revision 6, Sheet 1
W74-130, Revision 6, Sheets 1 and 2
W74-140, Revision 5, Sheets 1 through 4
W74-150, Revision 5, Sheets 1 and 2
3319, Revision 6, Sheets 1 through 5

(b) Contents

(1) Type and Form of Material

Shipment of spent fuel, with plutonium in excess of 20 curies per package, in the form of debris, particles, loose pellets, and fragmented rods or assemblies, is not authorized.

(i) W21 Canister

The contents of the W21 canister are limited to 21 pressurized water reactor (PWR) SNF assemblies meeting the requirements of Table 1 and Table 2. Two different loading configurations, designated as W21-1 and W21-2, are permitted in the W21 canister. The W21-2 loading configuration, which accommodates SNF with higher initial ^{235}U enrichments, consists of up to 20 PWR SNF assemblies meeting the requirements of Table 1 and Table 2. The W21-2 loading configuration requires that the center guide tube be mechanically blocked to prevent inadvertent loading of a SNF assembly. If less than the maximum number of PWR assemblies are loaded, dummy assemblies having a width, length, and weight similar to that of the PWR assemblies they are replacing, must be loaded in the empty guide tubes.

The SNF assemblies that are permitted in the W21 canister must meet all of the parameter requirements of at least one criticality class. Table 2 lists the dimensional and initial enrichment limits for each criticality class of PWR fuel assembly. Table 2 provides separate assembly initial ^{235}U enrichment limits for the W21-1 and W21-2 canister loading configurations. The initial enrichment limits presented in Table 2 are bounding for assemblies containing any type of control insert, including assemblies with fuel rods replaced with any type of rod of equal or greater diameter and height.

Table 3 lists minimum required cooling times, as a function of burnup, for PWR assemblies loaded into the W21 canister. For a given fuel burnup level, assembly radiation sources increase with decreasing initial enrichment. Table 3 lists two minimum initial enrichment values for each assembly burnup level. Table 3 also lists two different minimum allowable cooling times, corresponding to the two minimum initial enrichment levels. An assembly must have an initial enrichment level equal to or greater than the value shown in Table 3, to qualify for the corresponding minimum allowable cooling time also shown in Table 3. Assemblies with initial enrichment levels lower than the lowest values shown (for the assembly's burnup level) in Table 3 are not qualified for transportation in the W21 canister.

Table 3 also gives limits on the total amount of initial (pre-irradiation) cobalt that may be present in the assembly active fuel zone (including both assembly and control insert hardware). For assemblies with less than 11 grams of cobalt in the fuel zone, the shorter cooling times shown in Table 3 may be used (provided that the minimum initial enrichment requirement is also met). The longer cooling times shown in Table 3 must be used for assemblies with over 11 grams of cobalt in the fuel zone. Cobalt present in control components that do not extend into the assembly fuel zone (such as thimble plug assemblies) or that do not reside in the core during operation (such as control rod assemblies) do not need to be included in the total fuel zone cobalt content.

All PWR SNF assembly control inserts placed in the W21 canister must be intact, and may contain B_4C, borosilicate glass, silver-indium-cadmium, hafnium, or Gd_2O_3 poison materials. Control insert rod cladding, and other insert hardware may consist of any type of zircaloy, stainless steel, or inconel. Any PWR assembly control insert that meets these material requirements may be loaded into the W21 canister. Control inserts that employ solid inconel rods that reside in the core, such as the B&W Grey APSRA, are not qualified for transportation in the W21 canister. Any insert that contains significant quantities of inconel (such as inconel rod cladding) requires an evaluation of total assembly fuel zone cobalt quantity. Fuel rods may also be replaced with solid steel or Inconel rods, or rods containing any of the above poison materials, provided that the fuel zone cobalt requirements are met. UO_2 fuel rods containing Gd_2O_3 poison material are also permissible, although the poison is not relied upon to increase allowable ^{235}U initial enrichment levels for the fuel rod or assembly in question.

(ii) W74 Canister

The W74 canister contents are limited to 64 Big Rock Point (BRP) SNF assemblies without channels, including intact, partial, and damaged UO_2 and mixed oxide (MOX) fuel assemblies meeting the applicable acceptance criteria specified in Table 4 through Table 9. Specifications W74-1 and W74-2 for intact UO_2 and MOX fuel assemblies are provided in Table 4 and Table 5, respectively. Specifications W74-3 and W74-4 for partial UO_2 and MOX fuel assemblies are provided in Table 6 and Table 7, respectively. Lastly, specifications W74-5 and W74-6 for damaged UO_2 and MOX fuel assemblies are provided in Table 8 and Table 9, respectively. All UO_2 rods may contain any quantity of Gd_2O_3 poison material, provided that the specified ^{235}U initial enrichment limits are satisfied. BRP assemblies containing any amount of plutonium fuel (before irradiation) must meet the requirements of the MOX fuel specifications given in Table 5, Table 7, or Table 9. If less than the maximum number of BRP assemblies are loaded, dummy assemblies having a width, length, and weight similar to that of the BRP assemblies they are replacing, must be loaded in the empty guide tubes or support tubes.

The BRP UO_2 fuel assembly types permitted in the W74 canister are identified in Table 10. Any BRP fuel assemblies that do not meet all of the parameter requirements given for any fuel assembly class in Table 10 may only be loaded into the W74 canister damaged fuel can, as long as the requirements given in the applicable damaged fuel loading specification (W74-5 or W74-6) are still met. Any BRP fuel assemblies that meet all of the parameter requirements shown in Table 10, except for the requirement for the number of non-corner water holes, are classified as partial assemblies. The lower initial enrichment limits given in Specification W74-3 apply for those assemblies.

The specific BRP intact MOX fuel assembly types accommodated in the W74 canister are shown in Figure 1 through Figure 4. The specific BRP partial MOX fuel assembly types accommodated in the W74 canister are shown in Figure 5 through Figure 8. These figures show the maximum initial ^{235}U enrichment levels for the uranium present in all UO_2 and MOX fuel rods in each MOX assembly array. The figures also show the maximum overall weight percentage of PuO_2 in the initial MOX fuel rod (metal-oxide) material composition, with one exception. For the two MOX rods shown in Figure 4, the maximum total plutonium (metal) content, rather than the maximum overall weight percent of PuO_2, is specified. The limits on maximum burnup, maximum heavy metal loading, and minimum cooling time for each BRP MOX fuel type are shown in Table 11.

Table 1 - Generic Requirements for All W21 Canister PWR SNF Contents

Fuel Assembly Parameter	Requirement
Fuel Rod Cladding Material	Zircaloy 2, 4
Assembly Condition	Intact (1)
Maximum Assembly Width (inch)	8.54
Maximum Burnup Level (MWd/MTU)	60,000 (2)
Maximum Uranium Loading (MTU/assy)	0.471
Axial Uranium Loading (kg/assy-inch)	3.27
Maximum Fuel Zone Height (inch)	150
Maximum Fuel Pellet Stack Density	96.5% (3)
Minimum Bottom Nozzle Height (inch)	1.97 (4)

Notes:

(1) Intact assemblies have no known or suspected fuel rod cladding defects greater than pinhole leaks and hairline cracks. Intact fuel also has no detectable grid spacer damage, or axial shifting in grid spacer location. Fuel assemblies with missing fuel rods (from the standard rod array configuration) may be loaded if all missing fuel rods are replaced with dummy rods that have a height and diameter at least as great as that of a standard fuel rod (i.e., by rods that displace an equal or greater volume of water).

(2) For assembly burnups exceeding 45,000 MWd/MTU, it is necessary to verify that the cladding oxide layer thickness does not exceed 70 µm, by measurement of a statistical sample of limiting fuel assemblies. The exposure (burnup) of any inserted control component must not exceed that of the host fuel assembly.

(3) Defined as the average material density within the cylindrical envelope volume covered by the fuel pellets, relative to the theoretical UO_2 density of 10.97 g/cc. Thus, "smearing" over fuel pellet dishes and chamfers to determine the "stack" density is acceptable.

(4) The bottom nozzle height is defined as the distance between the assembly bottom and the bottom of the active fuel.

Table 2 - W21 Canister SNF Assembly Dimensional and Enrichment Limits

Fuel Assembly Class(1)	Criticality Class(1)	Max. Initial Enrichment (w/o ^{235}U)(2)		Number of Fuel Rods	Min. Clad O.D. (in.)	Min. Clad Thickness (in.)	Min. Pellet Diameter (in.)	Fuel Rod Pitch (in.)	No. Guide / Instrument Tube Locations(5)
		W21-1(3)	W21-2(4)						
B&W 15x15	B&W 15x15	4.70	5.00	208	0.4300	0.0265	0.3675	0.568	17
B&W 17x17	B&W 17x17	4.60	4.90	264	0.3770	0.0220	0.3232	0.502	25
CE 14x14	CE 14x14	5.00	5.00	176	0.4400	0.0260	0.3700	0.580	5(6)
	CE 14x14 A	5.00	5.00	176	0.4400	0.0260	0.3795	0.568	5(6)
Palisades	CE 15x15 P	5.00	5.00	208 - 216	0.4135	0.0240	0.3500	0.550	1-9
Yankee Rowe	15x16	5.00	5.00	231	0.3650	0.0240	0.3105	0.472	1
	15x16 A	5.00	5.00	237	0.3650	0.0240	0.3105	0.468	1
CE 16x16 CE System 80 St. Lucie 2	CE 16x16	5.00	5.00	236	0.3820	0.0250	0.3250	0.506	5(6)
WE 14x14	WE 14x14	5.00	5.00	179	0.4000	0.0243	0.3444	0.556	17
WE 15x15	WE 15x15	4.70	5.00	204	0.4200	0.0240	0.3569	0.563	21
	WE 15x15 A	4.90	5.00	204	0.4240	0.0300	0.3565	0.563	21
WE 17x17	WE 17x17	4.70	5.00	264	0.3740	0.0225	0.3195	0.496	25
	WE 17x17 A	4.60	4.90	264	0.3600	0.0225	0.3088	0.496	25
	WE 17x17 B	4.60	4.90	264	0.3600	0.0250	0.3030	0.496	25

Notes:

(1) Assembly class defined per Energy Information Administration, *Spent Nuclear Fuel Discharges from U.S. Reactors 1993*, U. S. Department of Energy, 1995. The fuel assembly criticality classes are arbitrary designations given to each set of assembly parameters that are evaluated for criticality.

(2) The maximum allowable enrichments apply for all assemblies that meet the specified physical parameter requirements for the defined assembly class. The maximum allowable enrichments are defined as the maximum planar average enrichment at any axial assembly location. An exception is the CE 15x15 P assembly class, for which the maximum allowable enrichment applies to each individual fuel pin within the assembly.

(3) This enrichment limit applies for up to 21 SNF assemblies, in any W21 canister guide tube.

(4) This enrichment limit applies for up to 20 SNF assemblies, with the center guide tube empty.

(5) Whereas the number of guide tube locations is a specified parameter, the materials and dimensions of the guide tubes are not specified, since any quantity of steel or zircaloy in the guide tube locations will reduce assembly reactivity. Guide tube locations may contain nothing, hollow zircaloy or stainless rods (or rod clusters), solid zircaloy or stainless rods (or rod clusters), or poison rods (or rod clusters).

(6) The CE 14x14 and CE 16x16 assembly guide tubes occupy four fuel rod locations within the assembly array.

Table 3 - W21 Canister Minimum PWR Assembly Cooling Time Requirements

Assembly Burnup Level (GWd/MTU)(1)	Assembly Initial Enrichment (w/o ^{235}U)(1)	Assembly Fuel Zone Cobalt Qty (g/assy)(2)	Required Cooling Time (years)
≤35	≥2.8 %	≤ 11	≥ 6
≤40	≥3.0 %	≤11	≥ 8
≤45	≥3.3 %	≤11	≥ 10
≤50	≥3.5 %	≤11	≥ 12
≤55	≥3.8 %	≤11	≥ 15
≤ 60	≥4.0 %	≤11	≥18
≤35	≥1.5 %	≤50	≥15
≤40	≥1.5 %	≤50	≥20
≤45	≥1.5 %	≤50	≥25
≤50	≥ 2.5 %	≤50	≥25
≤55	≥3.0 %	≤ 50	≥25
≤60	≥3.5 %	≤50	≥25

Notes:

(1) Assembly average values.

(2) Defined as the total initial (pre-irradiation) cobalt mass within the assembly fuel zone, including any cobalt present in inserted control components.

Table 4 - W74 Canister Contents Specification W74-1
Intact UO_2 Fuel Assemblies

SNF Parameter	Loading/Acceptance Criteria
Payload Description	≤64 Big Rock Point BWR intact UO_2 fuel assemblies. [1,2,3] Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable payload specifications W74-2 through W74-6, subject to the limitations of those specifications.
Cladding Material/Condition	Zircaloy 2,4 cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Maximum Uranium Loading	≤142.1 kg/assembly.
Maximum Initial Enrichment[4]	≤4.10 w/o ^{235}U.
Minimum Assembly Average Initial Enrichment	≥3.0 w/o ^{235}U.
Maximum Burnup	≤32,000 MWd/MTU.
Minimum Cooling Time	≥6.0 years.[5]

<u>W74-1 Notes:</u>

(1) Loaded assemblies must meet all of the assembly geometry requirements specified in Table 10, for any one of the defined assembly classes.

(2) Intact fuel assemblies include those BRP fuel assemblies with 1 to 4 corner rods missing, and BRP 9x9 fuel assemblies with 1 rod missing from a non-corner location. This includes assemblies with partial length rods, or rod fragments inside stainless tubes, in any of the array corner locations. It also includes 9x9 assemblies with 11x11 assembly rods in corner locations.

(3) Intact UO_2 assemblies may have any number of fuel rods replaced with solid zircaloy or stainless steel rods, or with poison rods, given that the length and diameter of the replacement rod are at least as great as that of the fuel rod. The empty array or guide tube locations may contain nothing, hollow zircaloy or stainless steel rods, neutron source rods, or any similar non-fissile fuel assembly component.

(4) Defined as the maximum array-average enrichment, which is the peak planar average initial enrichment considering all elevations along the assembly axis.

(5) If an intact UO_2 assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

Table 5 - W74 Canister Contents Specification W74-2
Intact MOX Fuel Assemblies

SNF Parameter	Loading/Acceptance Criteria
Payload Description	≤64 Big Rock Point BWR intact MOX fuel assemblies. (1,2,3) Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable payload specifications W74-1 and W74-3 through W74-6, subject to the limitations of those specifications.
Cladding Material/Condition	Zircaloy 2,4 cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Maximum Heavy Metal Loading	The heavy metal loading varies by MOX assembly type and must not exceed the maximum values defined in Table 11.
Allowable Fuel Composition	Maximum initial ^{235}U enrichment and maximum PuO_2 weight percentage is shown for every fuel rod location in the MOX assembly array in Figure 1 through Figure 4.(4,5)
Maximum Burnup	The burnup varies by MOX assembly type and must not exceed the maximum values defined in Table 11.
Minimum Cooling Time	The cooling time varies by MOX assembly type and must not be less than the minimum values defined in Table 11.(6)

W74-2 Notes:

(1) Intact MOX assemblies may have any number of fuel rods replaced with solid zircaloy or stainless steel rods, or with poison rods, given that the length and diameter of the replacement rod are at least as great as that of the fuel rod. They may also have hollow zircaloy or stainless steel rods, neutron source rods, or any similar non-fissile fuel assembly component placed in the empty array or guide tube locations, including all forms of inserts or control components.

(2) J2 (Figure 1) MOX assemblies must meet all of the assembly geometry requirements shown for Siemens 9x9 fuel in Table 10. DA and G-Pu (Figure 2 and Figure 3, respectively) MOX assemblies must meet all of the assembly geometry requirements shown for Siemens 11x11 fuel in Table 10. One exception is that J2 MOX assemblies with a cladding thickness of 0.05 inches and a fuel pellet diameter of 0.4515 inches are also acceptable. UO_2 9x9 assemblies with 2 inserted MOX rods (shown in Figure 4) must meet all of the assembly geometry requirements shown for Siemens 9x9 in Table 10.

(3) Intact G-Pu MOX assemblies may have 0 to 4 fuel rods in the array corner locations. G-Pu MOX assemblies may also have partial length rods, or rod fragments inside stainless tubes, in any of the array corner locations.

(4) The maximum ^{235}U enrichment shown in Figure 1 through Figure 4 is defined as the weight percentage of ^{235}U in any uranium that is present in the rod. The PuO_2 weight percentage is the overall mass of PuO_2 in the rod divided by the overall metal-oxide (UO_2 + PuO_2) mass in the rod. Fuel rods in candidate assemblies may have 235U enrichment levels and PuO_2 weight percentages that are equal to or less than the values shown in Figure 1 through Figure 4 for that fuel rod array location.

(5) Figure 4 specifies a maximum total MOX fuel rod plutonium metal mass as opposed to a maximum PuO_2 weight percentage.

(6) If an intact MOX assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

Table 6 - W74 Canister Contents Specification W74-3
Partial UO_2 Fuel Assemblies

SNF Parameter	Limit/Specification
Payload Description	≤64 Big Rock Point BWR partial UO_2 fuel assemblies.(1,2) Partial fuel assemblies are defined as those assemblies having one or more full-length fuel rods missing from the intact fuel assembly array (except as permitted by W74-1 Notes 2 and 3). The affected array locations may contain nothing, partial length rods, hollow zircaloy or stainless steel rods, neutron source rods, or any other non-fissile fuel assembly component with a lower length or diameter than a full-length fuel rod. Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1, W74-2, and W74-4 through W74-6, subject to the limitations of those specifications.
Cladding Material/Condition	Zircaloy 2,4 cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Maximum Uranium Loading	≤142.1 kg/assembly
Maximum Initial Enrichment(3)	≤3.55 w/o ^{235}U (9x9) ≤3.6 w/o ^{235}U (11x11)
Minimum Assembly Average Initial Enrichment	≥3.0 w/o ^{235}U
Maximum Burnup	≤32,000 MWd/MTU
Minimum Cooling Time	≥6.0 years(4)

<u>W74-3 Notes:</u>

(1) Partial UO_2 assemblies may have any number of fuel rods replaced with solid zircaloy or stainless steel rods, or with poison rods.

(2) Loaded partial assemblies must meet all of the geometry requirements shown (for any of the defined assembly classes) in Table 10, except for the "maximum number of non-corner water holes."

(3) Defined as the maximum array average initial enrichment, which is the peak planar average initial enrichment considering all elevations along the fuel assembly axis. The averaging is applied only to those fuel rods that are present in the partial array.

(4) If a partial UO_2 assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

Table 7 - W74 Canister Contents Specification W74-4 Partial MOX Fuel Assemblies

SNF Parameter	Loading/Acceptance Criteria
Payload Description	≤64 Big Rock Point BWR partial MOX fuel assemblies.[1,2,3] Partial MOX assemblies must conform exactly to one of the four partial assembly array configurations shown in Figure 5 through Figure 8, with respect to the number and location of missing fuel rods within the assembly array. The missing fuel rod array locations may contain nothing, hollow zircaloy or stainless steel rods, neutron source rods, or any other non-fissile fuel assembly component. Any remaining empty canister basket guide tubes and/or support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1 through W74-3, W74-5, and W74-6, subject to the limitations of those specifications.
Cladding Material/Condition	Zircaloy 2,4 cladding with no known or suspected cladding defects greater than hairline cracks or pinhole leaks.
Maximum Heavy Metal Loading	The heavy metal loading varies by fuel assembly type and must not exceed the maximum values defined in Table 11.
Allowable Fuel Composition	Maximum initial ^{235}U enrichment and maximum PuO_2 weight percentage is shown for every fuel rod location (in each of the four allowable partial MOX assembly array configurations) in Figure 5 through Figure 8.[4]
Maximum Burnup	The burnup varies by MOX assembly type and must not exceed the maximum values defined in Table 11.
Minimum Cooling Time	The cooling time varies by MOX assembly type and must not be less than the minimum values defined in Table 11.

W74-4 Notes:

(1) Partial MOX assemblies may have any number of fuel rods replaced with solid zircaloy or stainless steel rods, or with poison rods, given that the length and diameter of the replacement rod are at least as great as that of the fuel rod.

(2) If a partial MOX assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

(3) Loaded partial assemblies must meet all of the geometry requirements shown (for any of the defined assembly classes) in Table 10, except for the "maximum number of non-corner water holes."

(4) The maximum ^{235}U enrichment shown in Figure 5 through Figure 8 is defined as the weight percentage of ^{235}U in any uranium that is present in the rod. The PuO_2 weight percentage is the overall mass of PuO_2 in the rod divided by the overall metal-oxide (UO_2 + PuO_2) mass in the rod. Fuel rods in candidate assemblies may have ^{235}U enrichment levels and PuO_2 weight percentages that are equal to or less than the values shown in Figure 5 through Figure 8 for that fuel rod array location.

Table 8 - W74 Canister Contents Specification W74-5
Damaged UO_2 Fuel Assemblies

SNF Parameter	Limit/Specification
Payload Description	≤8 Big Rock Point BWR damaged UO_2 fuel assemblies. Damaged fuel assemblies are defined as those with fuel cladding damage in excess of hairline cracks or pinhole leaks. Fuel assemblies with damaged grid spacers (defined as damaged to a degree where fuel rod structural integrity cannot be assured, or where grid spacers have moved from their design position) are also considered to be damaged fuel assemblies. Each fuel assembly designated as damaged must be placed within a damaged fuel can and loaded into a basket support tube in the upper or lower basket. The remaining empty canister basket guide tubes and support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1 through W74-4 and W74-6, subject to the limitations of those specifications, for a total of ≤64 Big Rock Point BWR fuel assemblies. Any intact or partial UO_2 fuel assembly that does not meet all of the assembly geometry requirements shown in Table 10 (other than the number of water holes) must also be loaded into a damaged fuel can.
Cladding Material/Condition	Zircaloy 2,4 cladding with fuel rod damage in excess of hairline cracks or pinhole leaks.
Maximum Uranium Loading	≤142.1 kg/assembly.
Maximum Initial Enrichment	≤4.61 w/o ^{235}U peak fuel pellet initial enrichment.
Maximum Pellet Density	≤96.5% (as defined in Table 10, Note 1).
Minimum Assembly Average Initial Enrichment	≥3.0 w/o ^{235}U
Maximum Burnup	≤32,000 MWd/MTU.
Minimum Cooling Time	≥6.0 years.(1)

W74-5 Note:

(1) If a damaged UO_2 assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

Table 9 - W74 Canister Contents Specification W74-6
Damaged MOX Fuel Assemblies

SNF Parameter	Limit/Specification
Payload Description	≤ 8 Big Rock Point BWR damaged MOX fuel assemblies. Damaged fuel assemblies are defined as those with fuel cladding damage in excess of hairline cracks or pinhole leaks. Fuel assemblies with damaged grid spacers (defined as damaged to a degree where the fuel rod structural integrity cannot be assured, or where the grid spacers have shifted vertically from their design position) are also considered to be damaged fuel assemblies.Each fuel assembly designated as damaged must be placed within a damaged fuel can and loaded into a support tube locations in the upper and lower basket. The remaining empty canister basket guide tubes and support tubes may be loaded with fuel assemblies meeting any of the acceptable loading specifications W74-1 through W74-5, subject to the limitations of those specifications, for a total of ≤64 Big Rock Point BWR fuel assemblies. Any intact or partial MOX assembly that does not meet all of the assembly geometry requirements shown in Table 10 (other than the number of water holes) must also be loaded into a damaged fuel can.(1)
Cladding Material/ Condition	Zircaloy 2,4 cladding with fuel rod damage in excess of hairline cracks or pinhole leaks.
Maximum Pellet Density	96.5% (as defined in Table 10, Note 1)
Maximum Heavy Metal Loading	The heavy metal loading varies by MOX assembly type and must not exceed the maximum values defined in Table 11.
Allowable Fuel Composition	≤4.61 w/o ^{235}U for all UO_2 fuel pellets. All MOX fuel pellets must meet the maximum ^{235}U enrichment and PuO_2 weight percentage requirements for one of the four MOX fuel material compositions described in Figure 1 through Figure 3.
Maximum Burnup	The burnup varies by MOX assembly type and must not exceed the maximum values defined in Table 11.
Minimum Cooling Time	The cooling time varies by MOX assembly type and must not be less than the minimum values defined in Table 11.(2)

W74-6 Notes:

(1) The UO_2 9x9 assemblies with 2 inserted MOX rods (shown in Figure 4) may not be loaded into the W74 damaged fuel can.

(2) If a damaged MOX assembly has been further irradiated after having fuel rods replaced by dummy stainless rods, an evaluation must be performed that shows that the active fuel region non-fuel gamma source strength is bounded by that described in Section 5.2.2.1 of the WSNF-123 SAR. A similar evaluation is required for any assembly containing over 2.9 grams of initial cobalt in the assembly fuel zone.

Table 10 - W74 Canister Fuel Geometry Specifications

Fuel Assembly Parameter	Fuel Assembly Class			
	GE 9x9	Siemens 9x9	Siemens 11x11	Siemens 11x11A
Fuel Pellet Stack Density[(1)]	≤ 96.5%	≤96.5%	≤96.5%	≤96.5%
Number of Fuel Rods	≤ 81	≤ 81	≤121	≤ 121
Clad O.D. (in)	0.5625	0.5625	0.449	0.449
Clad Thickness (in)	0.040	0.040	0.034	0.034
Pellet Diameter (in)	0.471	0.4715[(2)]	0.3715	0.3735
Fuel Rod Pitch (in)	0.707	0.707	0.577	0.577
Active Fuel Length (in)	≤70	≤70	≤70	≤ 70
Number of Array Corner Rods[(3)]	0-4	0-4	0-4	0-4
Number of Non-Corner Water Holes[(3)]	≤ 1	0	0	0
Number of Inert Rods[(3)]	≥0	≥ 0	≥0	≥0
Bottom Tie Plate Height (in)[(4)]	≥1.25	≥1.25	≥1.25	≥1.25

Notes:

(1) The fuel pellet stack density is defined as the average density of the fuel pellet material (within the cylindrical envelope volume covered by the pellet stack) divided by the theoretical UO_2 density of 10.97 g/cc. Thus, smearing the fuel material over the dishing and chamfer voids in the pellet stack is acceptable for determining the stack density.

(2) Assemblies E65 and E72 may each contain two MOX fuel rods with either solid pellets or annular pellets with a 0.1 inch or 0.2 inch inside diameter. In any given MOX fuel rod, the entire pellet stack must contain the same pellet type (i.e., solid, 0.1-inch annular, or 0.2-inch annular).

(3) The definitions of corner rods, non-corner rods, and inert rods are given in the W74-1 and W74-3 assembly loading specifications.

(4) Defined as the distance from the bottom of the assembly to the bottom of the active fuel.

Table 11 - W74 Canister Assembly Specific Requirements for Big Rock Point MOX Fuel

BRP MOX Assembly Type	Maximum Heavy Metal Loading (kg)	Maximum Burnup (MWd/MTIHM)[(1)]	Minimum Cooling Time (years)
J2 (9x9)	124	22,820	22
DA (11x11)	126	21,850	22
G-Pu (11x11)	127	34,220	15
UO_2 9x9 with 2 inserted MOX rods	142.1	32,000	6

Note:

(1) The exposure (burnup) of any inserted control component must not exceed that of the host fuel assembly.

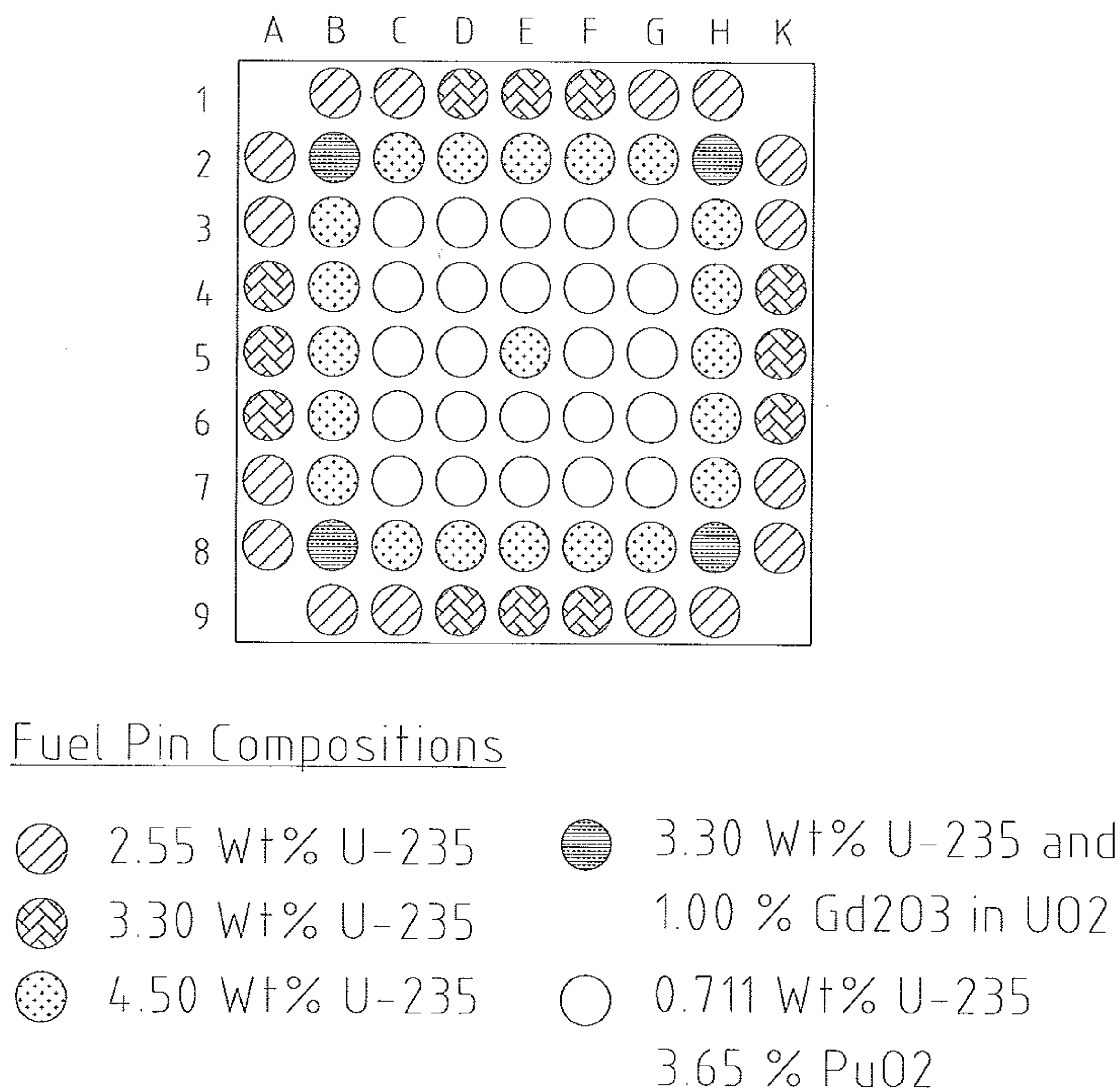
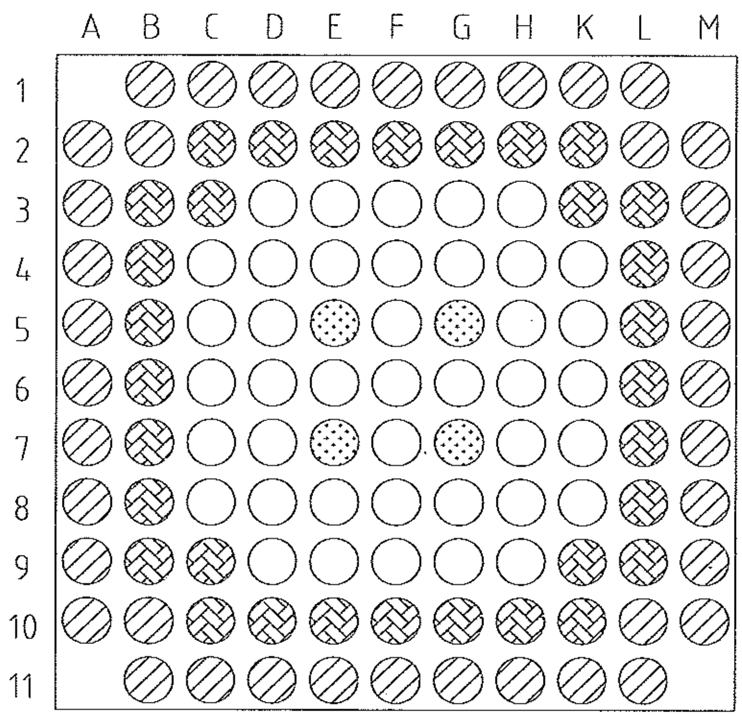


Figure 1 - J2 (9x9) BRP MOX Assembly Array

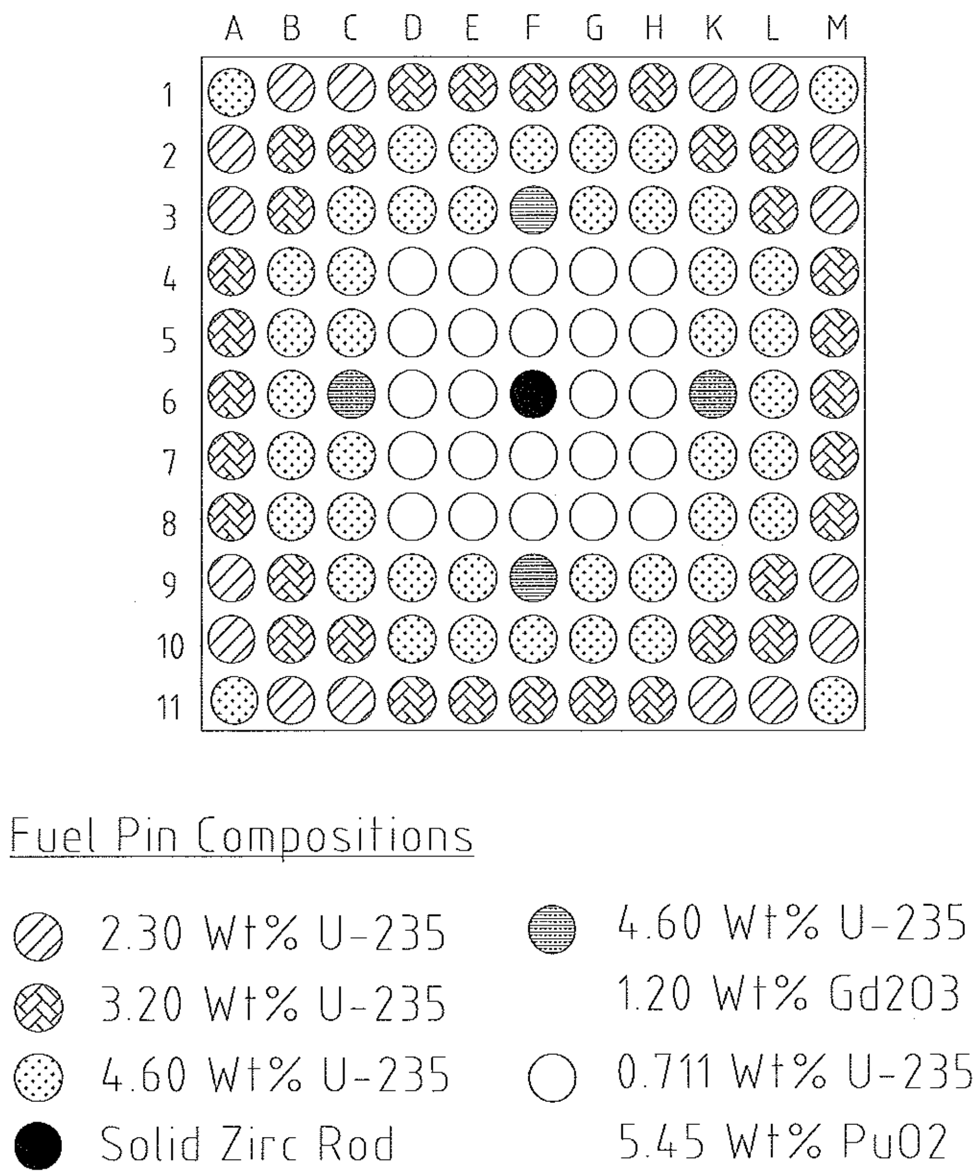


Fuel Pin Compositions

- 2.40 Wt% U-235
- 1.56 Wt% U-235 1.03 Wt% PuO2
- 2.40 Wt% U-235 2.45 Wt% PuO2
- Water Rods

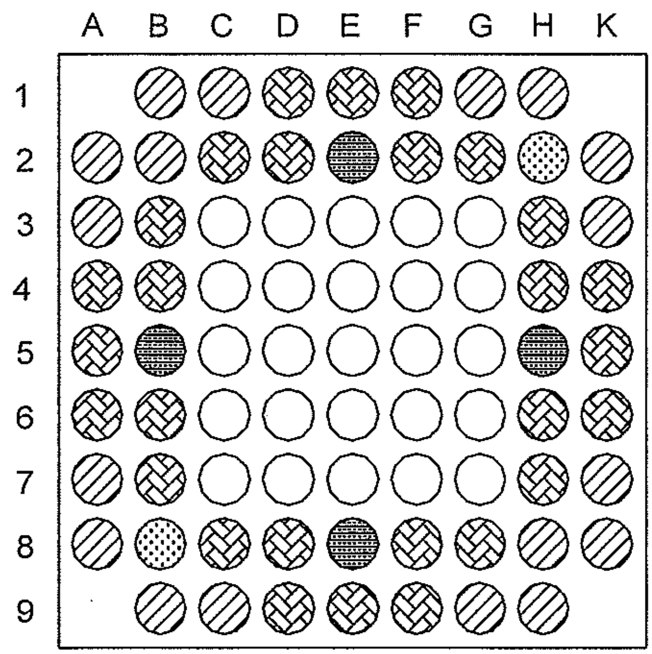
Note: Water rods are identical to the fuel rods (same diameter and cladding thickness), except that they contain no fuel pellets.

Figure 2 - DA (11x11) BRP MOX Assembly Array



Note: G-Pu assemblies may have any number of fuel rods missing (or present) in the four array corner locations

Figure 3 - G-Pu (11x11) BRP MOX Assembly Array



Fuel Pin Compositions

2.50 Wt% U-235

3.40 Wt% U-235

0.711 Wt% U-235
25.4 g/rod Pu

3.40 Wt% U-235
2.00 Wt% Gd2O3 in UO2

4.5 Wt% U-235

Figure 4 - UO2 9x9 BRP Assembly with Two Inserted MOX Rods

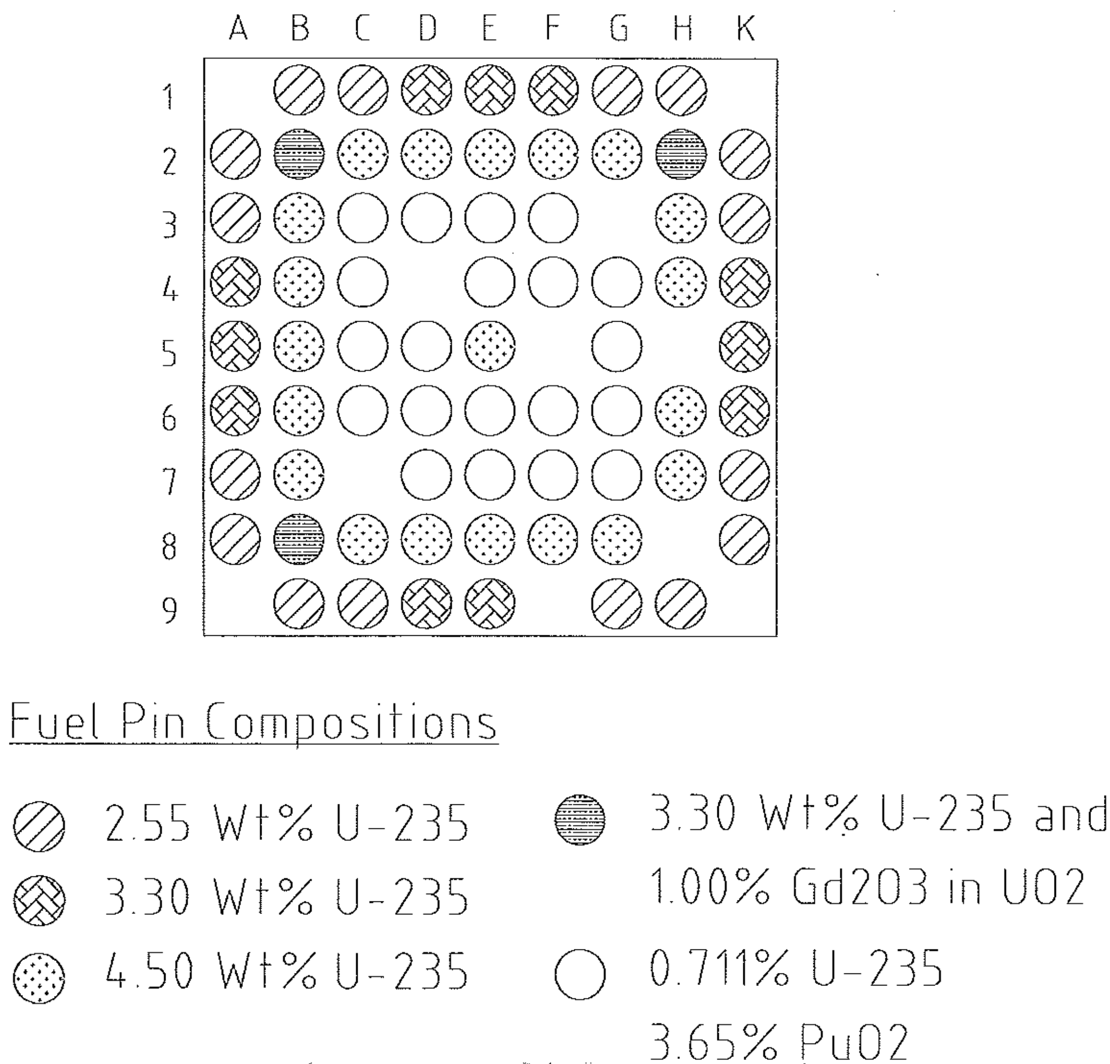


Figure 5 - J2 Partial MOX Assembly Array #1

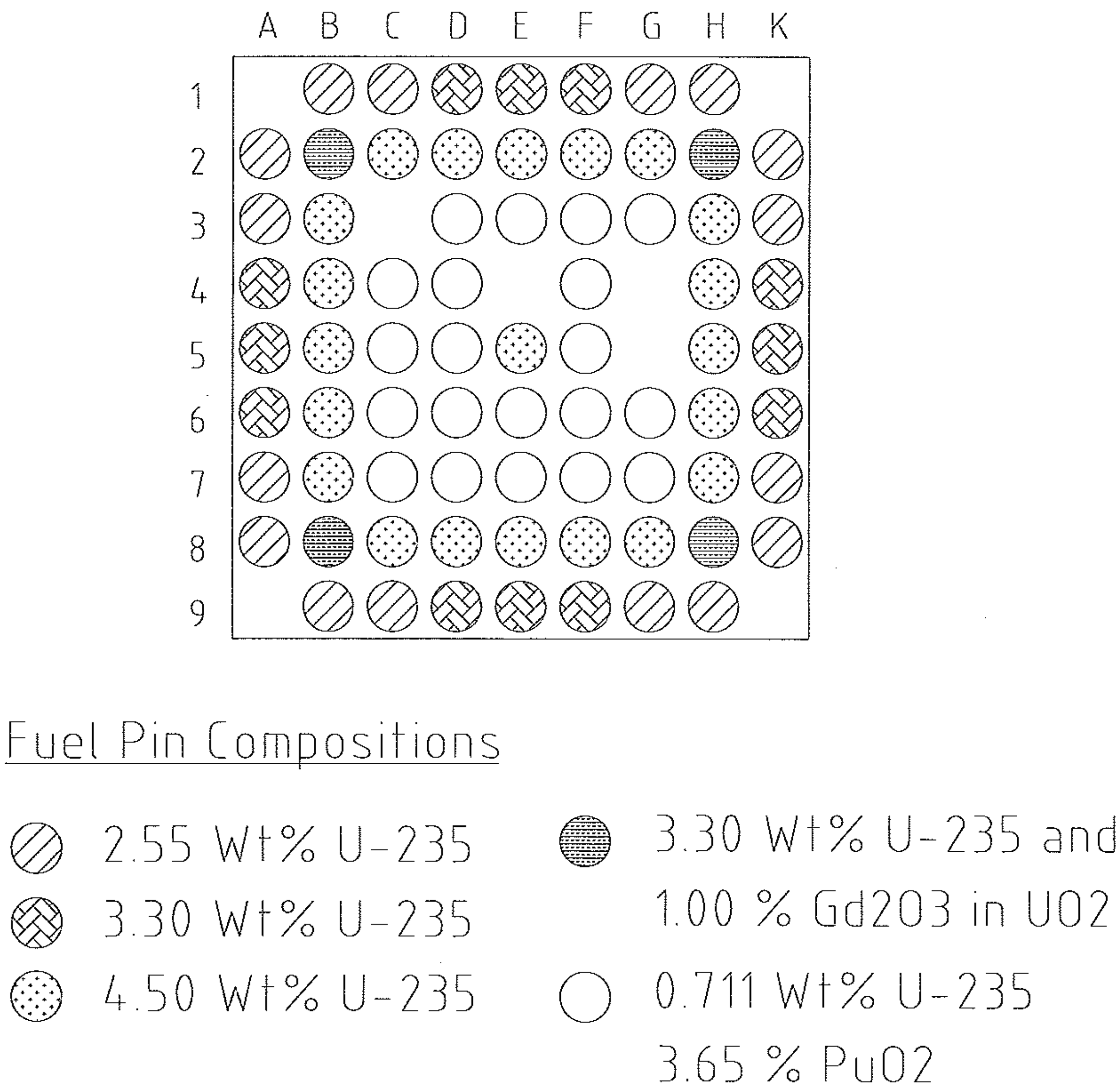


Figure 6 - J2 Partial MOX Assembly Array #2

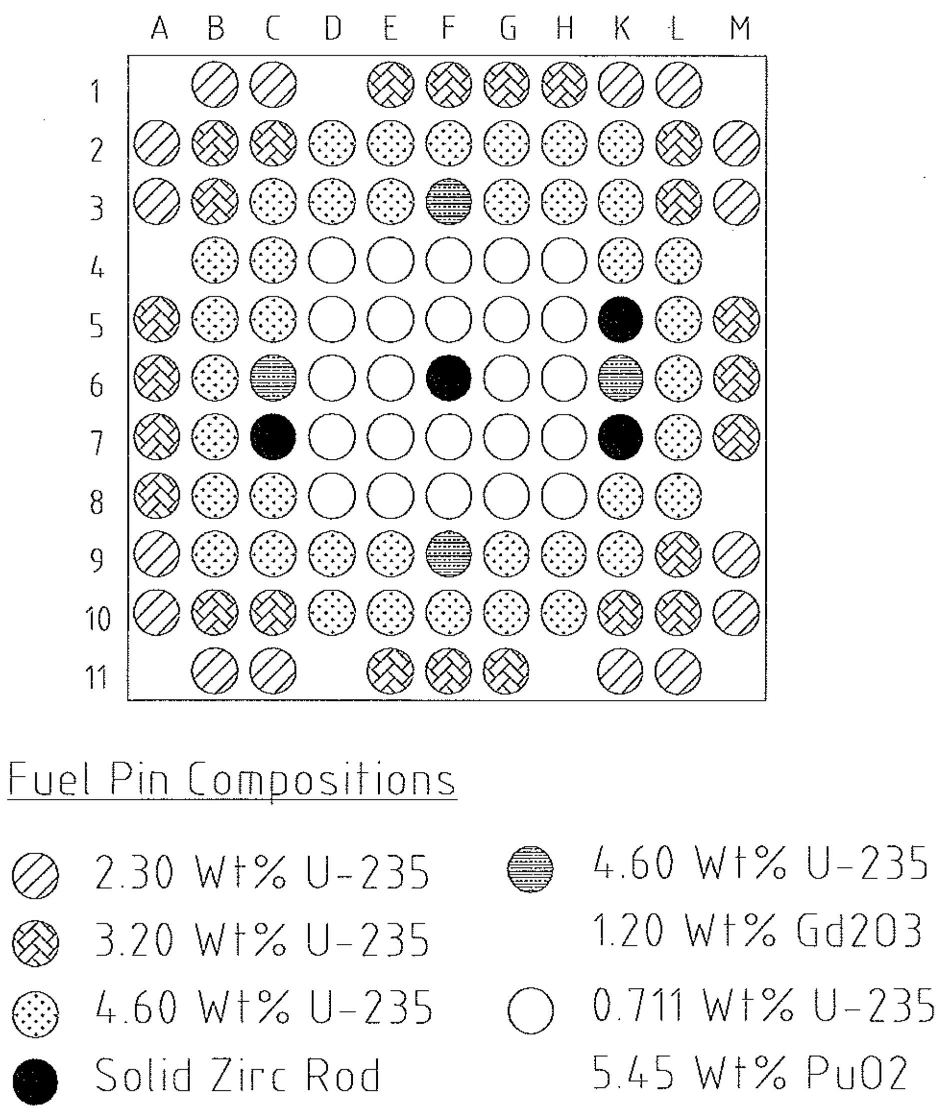


Figure 7 - G-Pu Partial MOX Assembly Array #1

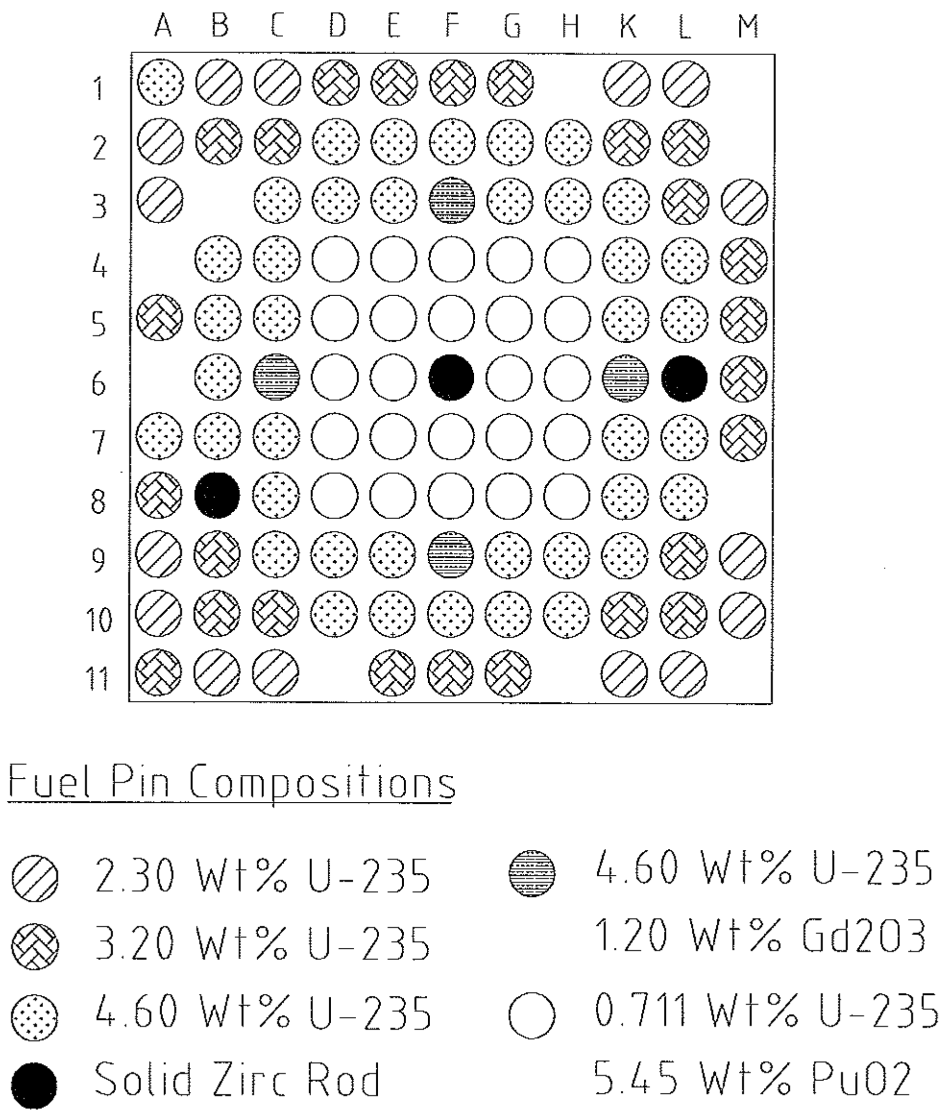


Figure 8 - G-Pu Partial MOX Assembly Array #2

(2) Maximum Quantity of Material Per Package

The maximum payload weight of the TS125 Transportation cask is 85,000 pounds. The payload weight includes the weight of the FuelSolutions™ canister and its SNF payload, plus the weight of the cask cavity spacer for short canisters.

(3) Decay Heat Limit
The W74 canister loading criteria can be described as follows:

A Big Rock Point spent fuel assembly is allowed to be shipped in the canister if Q (heat generation per assembly) $\leq$ 0.275 kW.

No decay heat limit is specified for the W21 canister. The PWR assembly fuel parameters requirements given in Table 3 ensure that assembly heat generation levels will not exceed the heat generation level that was analyzed in the thermal licensing evaluations (1.05 kW/assembly).

(c) Criticality Safety Index

(Minimum transport index
to be shown on label for
nuclear criticality control): 0.0

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

(1) The package shall meet the Acceptance Tests and Maintenance Program of Chapter 8 of the application, as supplemented.

(2) The package shall be prepared for shipment and operated in accordance with the Operating Procedures of Chapter 7 of the application, as supplemented.

7. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17, provided the fabrication of the packaging was satisfactorily completed by December 31, 2006.

8. Transport by air of fissile material is not authorized.

9. Expiration date: October 31, 2017

10. Fabrication of new packagings is not authorized.

REFERENCES

BNFL Fuel Solutions Corporation, application dated April 20, 2001.

Supplements dated June 7, 2001; January 22, February 5, February 28, April 11, and April 30,2002; January 17, August 7, and November 26, 2003; and April 20, April 28, April 29, May 7, May 12, 2004, August 27, 2007, and September 10, 2012.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Bernard H. White IV for

Michael D. Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: 10/26/12

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT
Docket No. 71-9276
FuelSolutions™ TS125 Transportation Package
Certificate of Compliance No. 9276
Revision No. 4

SUMMARY

By application dated September 10, 2012, Energy*Solutions* Spent Fuel Division, requested renewal of Certificate of Compliance No. 9276, for the Model No. FuelSolutions™ TS125 Transportation Package. The certificate has been renewed for a 5-year term that expires on October 31, 2017.

EVALUATION

By application dated September 10, 2012, Energy*Solutions* requested renewal of Certificate of Compliance No. 9276, for the Model No. FuelSolutions™ TS125 Transportation Package. In addition to their renewal request, Energy*Solutions* Spent Fuel Division provided their updated address.

The FuelSolutions™ TS125 Transportation Package is approved to ship pressurized-water reactor spent nuclear fuel in W21 canisters with a maximum burn up no greater than 60 GWd/MTU. Given staff's concerns with the effects of hydride reorientation on high burn-up spent fuel rods as stated in Interim Staff Guidance 11, Rev. 3, staff has not yet stated a position on the continued approval of transportation packages shipping this content. In this case, although the package has been previously approved for this content, it is limited by the provisions of 10 CFR 71.19(c). This regulation applies to a package with a -85 designation in the certificate's identification number and requires that all fabrication of this packaging must have been completed by December 31, 2006. To date, Energy*Solutions* has not fabricated any packagings and would therefore need to apply for a -96 designation in the certificate's identification number to fabricate and use this package. To address this regulatory requirement, Condition No. 10 was included in the certificate of compliance.

The staff reviewed the documents referenced in the certificate and determined that the documentation was available and complete.

CONDITIONS

The following changes have been made to the certificate of compliance:

Section 3 has been updated to reflect the correct address for Energy*Solutions* Spent Fuel Division.

Condition No. 9, which allows use of Revision No. 2 of this certificate until November 31, 2008, has been removed.

Condition No. 10 has been updated to No. 9 and reflects the new expiration date of October 31, 2017.

Condition No. 10 has been added to reflect the provisions of 10 CFR 71.19(c).

The references section has been updated to include this renewal request.

CONCLUSION

The certificate has been renewed for a 5-year term that expires on October 31, 2017. This change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9276, Revision No. 4, on 10/26/2012.